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A microscopic model for an emergent cosmological constant

We argue that discreteness at the Planck scale (naturally expected to arise from quantum gravity) might manifest in the form of minute violations of energy-momentum conservation of the matter degrees of freedom when described in terms of (idealized) smooth fields on a smooth spacetime. In the context of applications to cosmology such 'energy diffusion' from the low energy matter degrees of freedom to the discrete structures underlying spacetime leads to the emergence of an effective dark energy term in Einstein's equations. We estimate this effect using a (relational) hypothesis about the materialization of discreteness in quantum gravity which is motivated by the strict observational constraints supporting the validity of Lorentz invariance at low energies. The analysis yields a cosmological constant of the order of magnitude of the observed value without fine tuning.

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